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# Non-standard monetary policy measure - How the ECB's pandemic emergency purchase program (PEPP) affected Finnish industries

Bachelor's thesis
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**Abstract of bachelor's thesis**

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**Abstract**

The COVID-19 pandemic disrupted lives and businesses across the globe from the start of the year 2020. The ongoing pandemic made countries adopt unprecedented health security measures and restrictions, which in turn reduced the already declining aggregate demand. Alongside the traditional monetary policies, central banks adopted non-conventional monetary policies to promote economic activity.

ECB launched a new asset purchase programme in March 2020, the PEPP. The programme followed the doctrine of quantitative easing – instead of purchasing short-term securities similar to in open market operations, the programme primarily focused on long-term securities. This is believed to expand economic activity by increasing the liquidity in the financial system.

Furthermore, quantitative easing has also been used in previous economic crises by central banks, for example during the global financial crisis. Prior research suggests that quantitative easing has been temporally effective in increasing liquidity in financial systems, lowering interest rates on the securities under purchase, increasing aggregate demand and lowering negative impacts on real GDP and inflation. The quantitative analysis done in this paper showed that the PEPP purchases have had seemingly a negative impact on the industry turnover numbers in Finland.

**Keywords** Quantitative easing, COVID-19, ECB, PEPP, industry turnover

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# 1. Introduction

## 1.1. Background information

World Health Organization (WHO) declared a public health emergency of international concern in January 2020. China had reported a cluster of pneumonia cases at the beginning of the month, the cause of which was quickly confirmed to be a novel coronavirus. The virus rapidly spread across country borders to affect the entire globe. By the beginning of March over 100,000 cases were reported in more than 100 distinct countries, prompting WHO to extend their assessment of COVID-19 to being characterized as a pandemic. (WHO, 2020)

The COVID-19 pandemic disrupted lives across all countries and communities and had massive effects on the global economic growth in 2020 to an extent unrivalled in nearly a century (CRS, 2021). The disease propelled countries to instigate a plethora of health security measures and restrictions. The Finnish government, for instance, imposed a travel ban, closure of pubs and restaurants and regional lockdowns in the capital area and other virus hotspots amidst the pandemic (the Finnish Government, 2021; Yle, 2020; Yle, 2021 a).

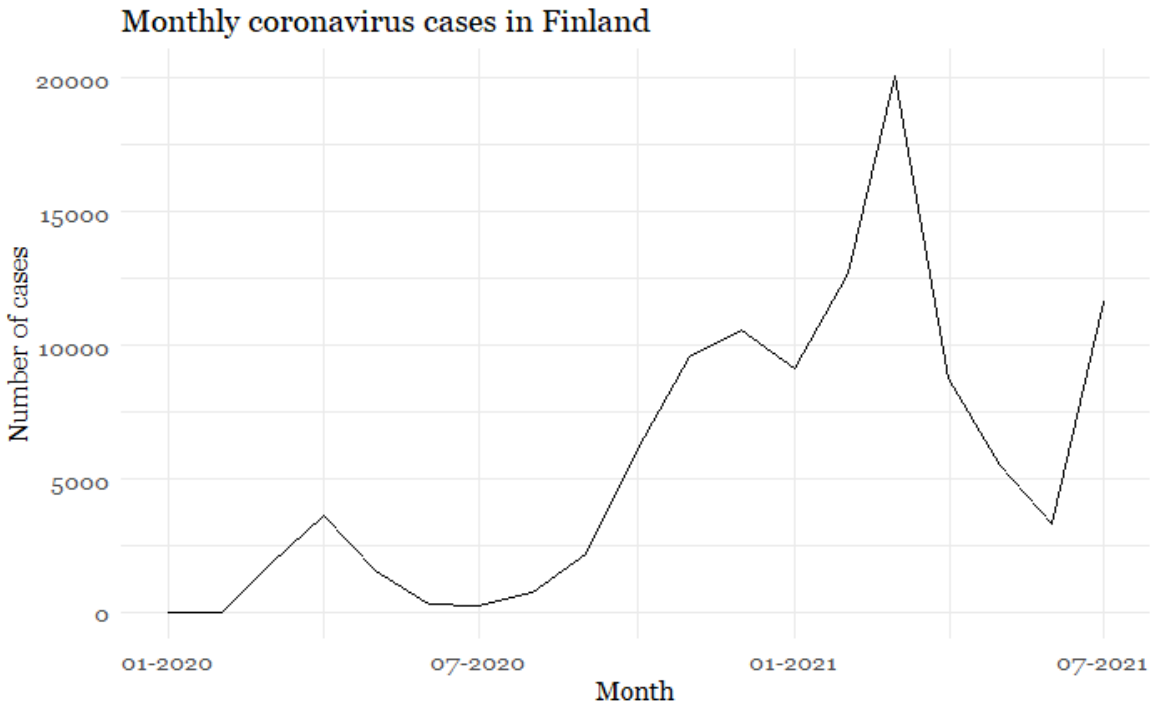


Figure 1. Monthly coronavirus cases in Finland (THL, 2021)

The numbers of monthly coronavirus cases in Finland are depicted in Figure 1. The first coronavirus wave can be seen in March 2020, after which the infection rate fell down to a manageable level for the summer of 2020. The second wave started in autumn 2020, while there has been a large dispersion in the number of observed cases, the monthly infection rate has been higher than the peak of the first coronavirus wave during this time. The latest increase in the infection rate is due to the new Delta variant of the virus (Yle, 2021 b).

However, the global economic downturn induced by the pandemic and the various safety measures and restrictions was not as negative as initially estimated, to some extent as a result of fiscal and monetary policies implemented by the governments in 2020 (CRS, 2021). Together with the conventional monetary policies, the European Central Bank (ECB) initiated a non-standard monetary policy measure to counter serious risks to the monetary policy transmission mechanism and the outlook for the euro area posed by the pandemic (ECB, 2021 a).

## 1.2. Research questions

This paper considers the quantitative easing-approach i.e., the pandemic emergency purchase programme, the European Central bank has undertaken to tackle the effects of COVID-19 pandemic. The main focus of the paper is on the outcome of economic activity in Finnish industries. The analysis is primarily performed by developing a fixed effects linear regression model to explain the net sales of various Finnish industries with PEPP purchase amounts. Other included aspects cover historical outcomes from quantitative easing. Hence, the research question can be concisely stated in two parts as:

1. How effective is quantitative easing as a non-conventional monetary policy tool?
2. How has PEPP affected economic activity in Finnish industries during the pandemic?

In order to answer the above questions, it is important to first examine the underlying reasons for the existence of such policy. Therefore, the paper also includes a rigorous study of the rationale behind quantitative easing. First, quantitative easing is presented with contrast to the standard monetary policy measures, including research from prior

adoption of quantitative easing. Second, methods and data used in the empirical approach of the paper are presented. Third, the results from the empirical analysis are disclosed. Finally, the paper ends with discussion and the conclusion of the thesis.

# 2. Quantitative easing as a monetary policy measure

This chapter discusses quantitative easing as a monetary policy measure. First the traditional monetary policy measures are defined, second the rationale behind quantitative easing is established, third prior research of quantitative easing effects are presented and fourth ECB's PEPP asset purchase programme is introduced. Quantitative easing (QE), a form of non-standard monetary policy measure, was born out of pure necessity. The unforeseen global financial crisis of 2008 led countries to pull out of recession through expansionary monetary policies i.e., policies which increase the money supply in the economy by, for instance, reducing the reserve requirements of banks. However, the standard expansionary monetary policies were not sufficient in combating the tenacious recession. In order to release their economies from the tight grip of the financial distress, central banks implemented non-standard monetary policy measures to complement the traditional monetary policies. (Kenton, 2021)

## 2.1. Traditional monetary policy measures

Central banks are state institutions, which usually have the power to regulate commercial banks, create monetary policies and provide financial services. The primary objectives of central banks are to help stabilize the currency of their respective nation, prevent excessive inflation and keep unemployment low. (Bankrate, 2021)

Generally, central banks have three traditional tools to implement monetary policy in the economy, namely:

- Open market operations
- Changing reserve requirements
- Changing the discount rate

The most common monetary policy tool of the three is open market operations. This approach takes place when a central bank sells or buys treasury bonds to manipulate the quantity of bank reserves and interest rate magnitudes. Changing reserve requirements refers to raising or lowering the reserve requirements i.e., the percentage of banks' deposit that they are legally required to hold. Central banks can also borrow as much cash as needed to banks experiencing bank runs, where depositors quickly withdraw their deposits for fear that otherwise they would lose their savings. The interest rate at which the central bank loans the banks is called the discount rate, and it corresponds to the face value of outstanding loans the banks use as collateral by default. Changing the discount rate is the third and final standard monetary policy tool. (Greenlaw, 2011)

## 2.2. Rationale behind quantitative easing

In the 2008 global financial crisis countries decided to promote economic activity by using the previously introduced traditional monetary policy tools in expansionary form (Kenton, 2021). This, in essence, refers to decreasing interest rates and increasing the amount of money in circulation (Greenlaw, 2011). Albeit these measures were not sufficient to tackle the ongoing recession. Therefore, the U.S. Federal Reserve decided to adopt a new innovative policy known as Quantitative easing (Greenlaw, 2011).

Quantitative easing involves the purchase of long-term government and private mortgage-backed securities by central banks to make credit available in order to stimulate the aggregate demand in the economy. The fundamental difference between open market operations and quantitative easing is simply that the securities purchased by central banks under quantitative easing include long-term government and private mortgage-backed securities. (Greenlaw, 2011)

On the other hand, open market operations centre around the purchase of treasury securities, but in the case of quantitative easing, private mortgage-backed securities were in addition feasible for purchase. This was effective to a large extent, as the crisis emerged from the burst housing bubble in the US. These securities were widely considered as "toxic assets" due to the fact. Hence, by removing these assets from the balance sheets of private financial firms, the US Federal reserve strengthened the financial system. (Greenlaw, 2011)

The imperative difference between the two approaches is, that the traditional method affects the short-term rates, while quantitative easing influences the long-term rates. In the case of the financial crisis, short-term rates were already as low as they could get, in some cases even negative. Hence, long-term rates were the new focus of policy measures. (Greenlaw, 2011)

Negative interest rates are generally considered a burden for the economy. From a historical point of view, negative interest rate policies (NIRP) have been an extremely rare phenomenon (Arteta, 2018). NIRP, for instance, weaken banks' willingness to lend, contribute to financial market distortions, further inflate asset prices, and possibly delay the implementation of necessary macroeconomic and structural policies (Carney, 2017; White, 2014). Therefore, further reducing the magnitude of the already low short-term interest rates could have had de facto negative implications on economic activity.

The aim of quantitative easing is to inject money into the economy to expand nominal spending. As the assets are purchased with new central bank money the amount of central bank money held by banks and the amount of deposits held by firms and households are increased. As the households and companies have more money to spend as a result, it is fair to expect that the nominal gross domestic product will also increase. (Benford, 2009)

Ongoing quantitative easing purchases have also been shown to improve financial market functioning by reducing liquidity premiums through a liquidity channel (Christensen, 2019). Liquidity premium refers to any form of additional compensation that is required to encourage investment in assets that cannot be without effort converted into cash at fair market value (Investopedia team, 2021). The significant effects appeared to be limited to only the targeted securities (Christensen, 2019).

## 2.3. Historical display of the effects of quantitative easing

Quantitative easing has been experimented on multiple occasions in the past, Japan implemented such a policy in March 2001 to combat stagnant economic growth and deflation, while the US Fed, Bank of England and ECB followed the example during the aftermath of the 2008 financial crisis (Baba, 2005; Urbschat, 2020). The European

Central Bank also continued the practice from September 2014 onwards through the Asset Purchase Programme (APP), which is a still ongoing effort (Urbschat, 2020).

When Japan started to adopt quantitative easing in 2001 the long-term interest rates were already at a very low level, and the opportunity to further reduce them through monetary policy was limited (Kimura, 2003). The abundant and flexible provision of liquidity successfully maintained easy monetary conditions, thereby preserving financial market stability (Kimura, 2003). Additionally, the long-term yields were lower than what was expected as a result of the quantitative easing (Bernanke, 2004). Furthermore, the market operations prevented Japan from falling into a liquidity crisis, albeit the reductions in risk premiums did not spread into other markets, where credit constraints had been strict (Baba, 2005).

The quantitative easing policy the United States undertook after the 2008 financial crisis yielded dissimilar results to that of Japan's experiment. The Federal Reserves programme seemed to only affect short- and medium-term forward rates, up to approximately 12 years, after which the programme had no discernible effects. The programme focused on Treasure purchases with maturities lower than ten years, which might explain the little to no spill-over effect in 20- and 30-years bonds. In addition, the programme did not introduce arbitrage opportunities into the markets i.e., the possibility to take advantage of exchange rates between two different markets. (Jarrow, 2014; Greenlaw, 2011)

The Bank of England adopted a quantitative easing programme from March 2009 to January 2010 to combat the effects of the global financial crisis. Previous research has shown the programme to have expanded economic activity in England during this time. Without the QE real GDP would have decreased significantly more during this time period, and inflation would have reached extremely low or even negative levels. (Kapetanios, 2012)

ECB's Asset Purchase Programme was adopted as a measure to combat deflationary trends in the Euro Area. Interestingly, the programme demonstrated that the marginal impact of every additional package decreased over time. In some cases, market participants expected larger packages than provided, or the removal of institutional constraints. The APP had weak effects compared to QE programmes by other central

banks, possibly because of the announcement of the programme during calm times. (Urbschat, 2020)

### 2.4. Pandemic Emergency Purchase Programme (PEPP)

European Central Bank initiated the pandemic emergency purchase programme (PEPP) in March 2020 as a response to the economic downturn produced by the Covid-19 pandemic. The coronavirus pandemic had hurt economies across the globe – businesses went bankrupt in the masses and waves of layoffs took place. The PEPP was launched to help people and businesses to get access to affordable funds during the crisis, complementing ECB's other monetary policy measures, including the 2014 launched APP. PEPP and APP were mainly launched due to the inability to expand other monetary policy measures, for example because of the already zero interest rate. (ECB, 2021 b)

The PEPP is a temporary asset purchase programme of private and public sector securities, the envelope of which reaches a total of €1,850 billion. Assets purchased under the PEPP include corporate and public sector securities, asset-backed securities and third covered bonds. The PEPP is to be terminated by the Governing Council once it judges that the Covid-19 crisis phase is over, but not before the end of March 2022. The cumulative net purchases at the end of July 2021 directed to Finland were of €21 billion. (ECB, 2021 a)

The programme is a non-conventional example of quantitative easing – in addition to the purchase of long-term government and private mortgage-backed securities, the PEPP additionally includes corporate sector purchases with at least 28 days remaining maturity and public sector securities with residual maturity from 70 days up to a maximum of 30 years and 364 days (ECB 2021). Hence, PEPP is not purely an instance of quantitative easing, but a mixture of open market operations and QE.

## 3. Methods and data

This chapter presents the methods and data used in this paper. First the data and its sources are presented and second the empirical strategy is presented. To assess the effect of PEPP has had on Finnish industries during the Covid-19 pandemic, a panel

analysis is conducted by fitting a panel data regression model. The analysis attempts to explain the variation in the net sales of assorted industries on aggregate level through PEPP purchases and the number of coronavirus cases. The dataset used in the analysis has been constructed from various sources, further described in the upcoming sections.

## 3.1. Data

The global effects of Covid-19 pandemic first began in early 2020, while the first recorded coronavirus cases in Finland appeared in January 2020 (THL 2021). However, the Pandemic emergency purchase programme was adopted during March 2020 (ECB 2021). As the pandemic is still an ongoing matter during the writing of this paper, the time scope of the analysis extends from January 2020 to the most recent available data i.e., that of July 2021. The numbers are observed on monthly level.

As previously mentioned, the dataset includes monthly numbers on the following issues:

- Index series of industry level net sales
- Purchase amounts under the PEPP
- Coronavirus infection numbers in Finland

The index series of industry level turnover numbers were retrieved from Statistics Finland databases. Statistics Finland, the national statistical institution of Finland, is an expert organisation producing reliable statistics, surveys and datasets describing conditions society for fact-based decision-making. The statistics are also readily available to all on their website. The organization produces a vast array of statistical data, including monthly turnover time series for selected industries.

The turnover numbers were retrieved as index time series from the following four distinct Statistics Finland tables:

- Turnover of trade monthly (Stat, 2021 a)
- Index of turnover of construction monthly (Stat, 2021 b)
- Turnover of service industries monthly (Stat, 2021 c)
- Index of turnover in industry monthly (Stat, 2021 d)

The tables use 2015 as the base year for the index calculation, the index point figure for each point in time tells what percentage the given examined variable is of its respective value at the base point in time. The Standard Industrial Classification TOL (Stat, 2020) of the included industries from each table is presented in Table 1.

| Source table | Industry classification under TOL |
|---|---|
| **Industry** | B – Mining and quarrying<br>C – Manufacturing<br>D – Electricity, gas, steam and air conditioning supply<br>E – Water supply, sewerage, waste management and remediation act |
| **Construction industries** | F - Construction |
| **Trade industries** | G – Wholesale and retail trade |
| **Service industries** | H – Transportation and storage<br>I – Accommodation and food service activities<br>J – Information and communication<br>L – Real estate activities<br>M – Professional, scientific and technical activities<br>N – Administrative and support services activities<br>R - Arts, entertainment and recreation<br>S – Other service activities |

Table 1. Industries retrieved from the Statistics Finland database, as classified by the Standard Industrial Classification (TOL)

The European Central Bank has collected the monthly aggregate purchases under the pandemic emergency purchase programme, and the data is available on their PEPP web page (ECB 2021 a). The dataset retrieved for this paper is the history of monthly net purchases under the PEPP aggregated over all the countries involved in the asset purchases. The dataset includes also the cumulative net purchases under PEPP, however only the monthly net purchases are used as a part of the analysis. The effects of the purchases may be lagged i.e., the effects can be seen after certain time period.

Therefore the analysis also incorporates different lags to determine the relationship between the asset purchases and the industry turnover numbers.

The number of coronavirus infection cases was retrieved from Finnish institute for health and welfare (THL). THL has been collecting the number of cases from the beginning of the pandemic and provides the data via open data API. The data includes daily infection cases per municipality, but the analysis only uses the aggregate level numbers for whole Finland. As previously noted, the number of infection cases is also observed on monthly level.

The aforementioned datasets are merged into one dataset, which is then transformed into longitudinal data i.e., there is a distinct row for every timepoint and industry. The panel dataset can be used as such in the analysis of the effects.

## 3.2. Empirical strategy

A linear fixed-effects regression model is used in the investigation of the effects PEPP purchases have had on the industry turnover numbers. Fixed-effects models differ from the more common random-effects models by the possibility of controlling variables that cannot be measured. More precisely, in fixed-effects models we have multiple observations of a phenomenon for one individual over time, and multiple individuals in the data. In order to assess the effects of an external event on a feature of the individuals, we can estimate the effects of the event on each individual separately and then average the parameter estimates across the individuals. (Allison, 2009)

The fixed-effects model can be built with our longitudinal data directly. The approach in essence is that, as there is a row for all of the timepoints and industries, the model can be trained for each industry individually and then averaging the estimates across the industries. This will lead to one estimate of the effect of PEPP purchases on the industry turnover numbers.

The fixed-effects regression model is defined as follows:

$$Y_{it} = \alpha_t + \beta x_{it} + \gamma z_i + \varepsilon_i, \quad i = 1, \dots, n \quad t = 1, \dots, T,$$

where $\alpha_t$ is the intercept term, $\varepsilon_i$ is the error term, $x_{it}$ is the set of predictor variables which vary over time, $z_i$ is a set of predictor variables which do not vary over time and $\beta$ and $\gamma$ are vectors of coefficients. (Allison, 2009)

To assess if the relationship between the response variable and the explanatory variables is indeed linear, the model can be also estimated incorporating the squared values of the explanatory variables. Provided that the explanatory power of the model increases, and the statistical significance of the coefficient estimates persists, we come to a conclusion that the relationship can be best modelled via the more complex model. The explanatory power of the model is measured using the coefficient of determination, denoted as $R^2$, whereas the statistical significance of the estimated coefficients is tested using an F-test and the consequent p-value. All of the respective coefficients are also tested to be significant by using a t-test with a null hypothesis that the coefficient is equal to zero.

In some cases, the error term $\varepsilon_i$ might be dependent on the value of t or $x_{it}$. This is called heteroskedasticity, and it means that the variability of the error term is not constant across elements of the $x_{it}$. Heteroskedasticity can strongly affect the results of the model estimation, and hence the phenomenon should be thoroughly investigated. This can be done by comparing the standard error terms of the model to a model with robust standard errors. (Hanck, 2020)

The estimated fixed-effects regression model will be in the following form:

$$Turnover_A = Industry_A + a \times Cases + b \times PEPP,$$

where $Turnover_A$ signifies the turnover for industry A, $Industry_A$ signifies the estimated coefficient for industry A, $a$ and $b$ signify the estimated coefficients for the number of cases and asset purchases under PEPP, $Cases$ signifies the number of cases and $PEPP$ signifies the asset purchases under PEPP.

Causality analysis is out of the scope of this paper, i.e., the variation in the explanatory variables might be able to explain the variation in the response variable, but it is not assessed if the variation actually caused the changes in the response variable.

# 4. Results

This chapter presents the results of the empirical analysis. First the results of the qualitative analysis are presented and second the results of the quantitative analysis are presented. The objective of this thesis is to assess the effects that European Central Banks Pandemic emergency purchase programme purchases have had on the industry turnover numbers. Hence, the response variable is turnover, while the explanatory variables include industry, PEPP purchases and coronavirus cases in Finland. While the effects could be modelled with only the industry and PEPP purchases, the turnover numbers have been greatly affected by the changes of the infection rate and the subsequent health security measures and restrictions by the Finnish government.

## 4.1. Qualitative analysis

The qualitative analysis gives insight to the data used in the analysis. The industry turnover number time series is depicted in Figure 2. The previously mentioned correlation between the industry turnover numbers is apparent in the graph, the largest fluctuations seem to extent cross the industry borders. Interestingly, as depicted in Figure 1., the coronavirus infection rate waves reached their peaks in April 2020, December 2020 and March 2021. The industry turnover numbers can be seen to decrease the next month in contrast to the infection rate peaks without a fail, possibly due to higher extent of health security measures.

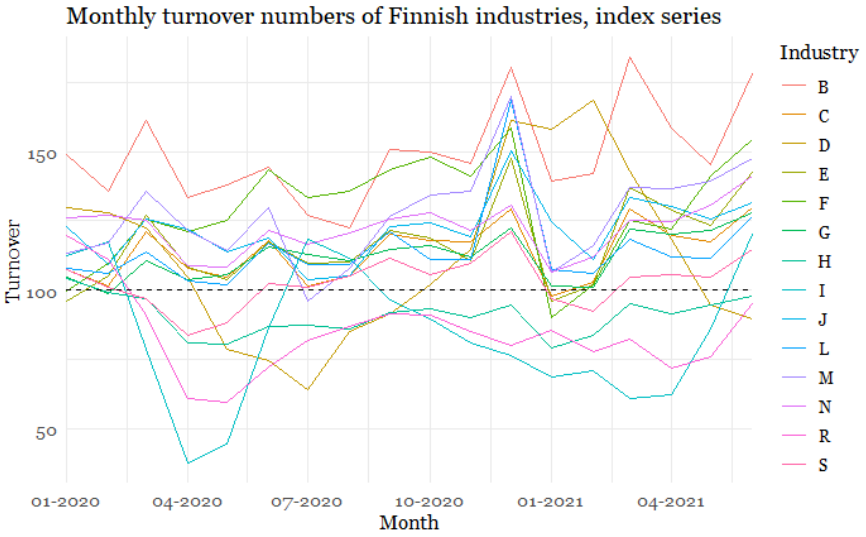

Figure 2. Monthly turnover numbers of Finnish industries, index series

The time series of monthly asset purchases under PEPP is depicted in Figure 3. Comparing the figure to Figure 2. clearly shows that there is insignificant correlation between the PEPP purchases and the industry turnover numbers. It can be seen from the figure, that the asset purchases were initially higher until stabilizing at approximately 75 billion euros, which is also the average of the purchases.

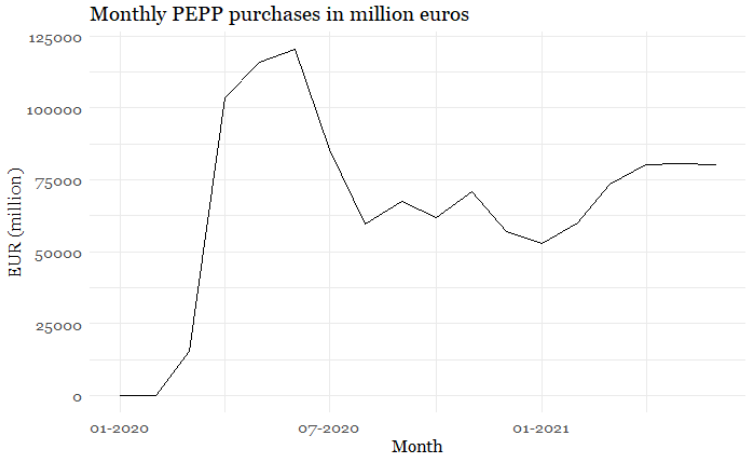


Figure 3. Monthly PEPP purchases in million euros

The correlation matrix of the variables is displayed in Figure 4. In the figure, PEPP corresponds to the net asset purchases under the Pandemic emergency purchase programme, Cases corresponds to the monthly number of coronavirus cases in Finland, whereas the letters specify the industry for industry turnover numbers as classified by the Standard Industrial Classification (TOL) displayed in Table 1. It can be seen that the PEPP purchases have only weak positive or negative correlation with the turnover numbers, whereas the coronavirus cases have generally weak positive with few instances of weak negative correlation. This gives indication that these variables have only weak or no linear relationship with the response variable, and hence their respective explanatory power in simple linear regression would be weak. The industry turnover numbers can be seen to be mostly positively correlated, with the exception of industries D, I and R.

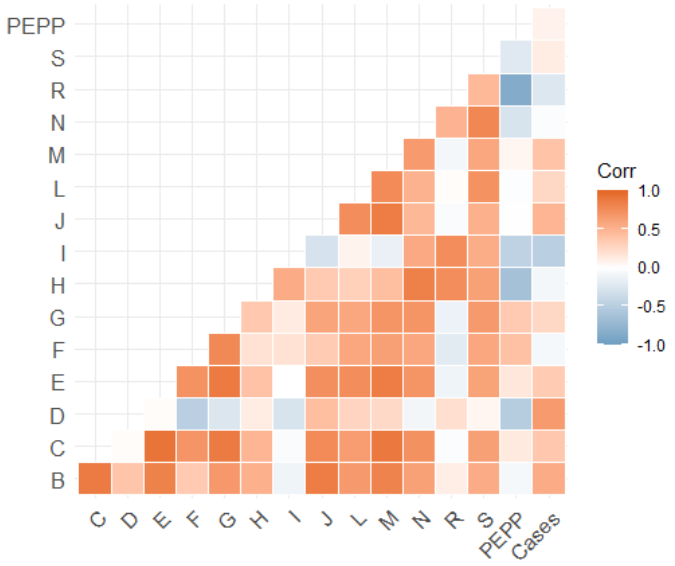


Figure 4. Correlation matrix of the industry turnover numbers, PEPP purchases and coronavirus cases in Finland

## 4.2. Fixed-effects regression model

As previously mentioned, the fixed-effects regression is done using an OLS linear model. The response variable is an index series of industry turnover numbers with 2015 as the base year, while the explanatory variables include monthly coronavirus cases in Finland, industry and monthly net asset purchases under the pandemic emergency purchase programme.

The results from the estimated fixed-effects linear regression models with different lagged effects of purchases under the PEPP are displayed in Table 2. The industry effects are constant within the industries, only changing the industry yields a change in the value. In this sense, the estimated coefficients for industries work as intercept terms for each industry. The effects are distributed about the initial rate of the index, 100. The estimated model counterintuitively implies that the number of coronavirus cases have a positive effect on the turnover numbers, whereas the PEPP purchases have a negative effect.

A possible explanation for the positive effect of the coronavirus cases, is that the effects could be lagged. In essence, it is to some extent expected that a change in the number of coronavirus cases would not have immediate effects to the industry turnover numbers. For example, when the number of coronavirus cases increases the

government does not immediately increase the health security measures. Hence, when the measures are in place, and the industry turnovers would be expected to decrease, the infection rate is already decreasing.

However, the negative effect of the purchases under PEPP cannot be explained by a lagged effect. All of the regression models up to five lags yielded a negative effect, while the estimated coefficients of only the two statistically most significant lagged models are displayed in Table 2. Giving a reasonable explanation to these observations is not within the scope of this paper, and hence no further discussion is provided on the matter.

The interpretation of the estimated coefficients of the model without lagged effects is as follows. Approximately 1737 monthly coronavirus cases increase the turnover index by one. Furthermore, as the PEPP purchases were in million euros, a total net purchase of 100 billion for a month would decrease the industry turnover index by 8.151. The average monthly net purchases under the PEPP equal 75 billion, hence the industry turnover indexes have been about 6.113 lower than they would have been without the purchases according to the model.

| | **Coefficient estimates** | | |
|---|---|---|---|
| | **No lag** | **Lag 1** | **Lag 4** |
| **Cases** | 0.0005756 | 0.0006597 | 0.0004121 |
| **PEPP** | -0.00008151 | -0.0001448 | -0.0004466 |
| **B** | 151.5 | 155.2 | 149.7 |
| **C** | 116.1 | 119.8 | 114.2 |
| **D** | 115.0 | 118.7 | 113.1 |
| **E** | 119.3 | 123.0 | 117.4 |
| **F** | 131.1 | 134.9 | 129.3 |
| **G** | 114.6 | 118.3 | 112.8 |
| **H** | 93.0 | 96.70 | 91.14 |
| **I** | 86.6 | 90.36 | 84.79 |
| **J** | 124.2 | 128.0 | 122.4 |
| **L** | 116.9 | 120.6 | 115.0 |
| **M** | 129.2 | 132.9 | 127.4 |
| **N** | 124.6 | 128.3 | 122.7 |
| **R** | 86.6 | 90.35 | 84.78 |
| **S** | 105.2 | 108.9 | 103.4 |

Table 2. Coefficient estimates from the model for different lagged effects of PEPP

All of the coefficients of the model were significant on their own accord on a significance level of 0.01. Moreover, the p-value for the F-test was lower than what the

statistical program used in the analysis was able to display i.e., the model is seemingly significant. Furthermore, the coefficient of determination for the model was 0.982, implying that the model has high explanatory power.

The more complex polynomial regression model yielded similar results in almost all respects. The main difference is that adding the second powers of the asset purchases and the number of cases reduced the statistical significance for the coefficients of both the variables. While the coefficients of those variables in the linear model were non-zero with a statistical significance, now the statistical significance is non-existent on all significance levels. As the explanatory power did not increase, we can safely assume that the coefficient estimates from the linear model are the best estimates in this case.

As mentioned before, the standard deviations of the response variable could be heteroskedastic, violating the assumptions for linear regression modelling. This could in the end affect the validity of the analysis, and therefore must be addressed. The approach used in this paper is to model another fixed-effects linear regression model with robust standard error terms and compare the standard errors and coefficient estimates between the two models with no lag.

The aforementioned standard errors and coefficient estimates can be found in Table 3. Interestingly, while the standard errors do have a small difference between the models, the coefficient estimates are equal. Furthermore, as the estimated coefficients are identical, the possible heteroskedasticity has not violated the model integrity and the results remain relevant.

| **Variable** | **Standard error terms** | | **Robust standard error terms** | |
|---|---|---|---|---|
| | Estimate | Std. Error | Estimate | Std. Error |
| Cases | 0.0005756 | 0.000189 | 0.0005756 | 0.000198 |
| PEPP | -0.00008151 | 0.0000307 | -0.0008151 | 0.0000292 |
| B | 151.5 | 4.35 | 151.5 | 4.24 |
| C | 116.1 | 4.35 | 116.1 | 3.24 |
| D | 115.0 | 4.35 | 115.0 | 6.64 |
| E | 119.3 | 4.35 | 119.3 | 4.24 |
| F | 131.1 | 4.35 | 131.1 | 5.55 |
| G | 114.6 | 4.35 | 115.0 | 3.12 |
| H | 93.0 | 4.35 | 93.0 | 2.64 |
| I | 86.6 | 4.35 | 86.6 | 6.28 |
| J | 124.2 | 4.35 | 124.2 | 3.22 |
| L | 116.9 | 4.35 | 116.9 | 3.97 |
| M | 129.2 | 4.35 | 129.2 | 4.51 |
| N | 124.6 | 4.35 | 124.6 | 2.91 |

| | | | | |
|---|---|---|---|---|
| R | 86.6 | 4.35 | 86.6 | 4.20 |
| S | 105.2 | 4.35 | 105.2 | 2.88 |

Table 3. Coefficient estimates and standard error terms for the models with and without heteroskedasticity considered

# 5. Conclusions and discussion

This chapter first presents discussion to the empirical analysis and second discloses the conclusion of the thesis. The empirical analysis provided in this paper contained some deficiencies. Firstly, the panel regression model is a simple linear approach to assess a complicated relationship between the purchases and industry outcomes. The strong linear relationship in certain cases only implies correlation between the PEPP purchases and the industry specific turnovers, however the analysis does not address causality of the purchases on the outcomes. Building a time series model and testing for Granger causality could have given insight on the actual outcomes of the purchases on industry turnover numbers.

Secondly, previous research has shown that the benefits of quantitative easing do not spill over between securities, hence concentrated purchases in one country, or on one specific industry should not have effects in other places (Jarrow, 2014). As ECB does not provide country specific PEPP purchase numbers and the Bank of Finland does not publish purchases or possessions on industry or corporate level, the actual explanatory power of the panel regression analysis should not be as good as demonstrated.

Thirdly, while the Pandemic emergency purchase programme started in March 2020, The ECB's asset purchase programme was initiated already in mid-2014 (ECB, 2021 c). While PEPP is not directly under APP, all of the asset categories eligible under the existing programme were also eligible under PEPP (ECB, 2021 a). Furthermore, the adoption of PEPP did not terminate APP, asset purchases continued under both the programmes. Therefore, the actual realized effects of PEPP are challenging to distinguish when the APP purchases are not accounted for in the model.

Nevertheless, the fixed-effects linear regression model suggests that the European Central Bank's asset purchases under the pandemic emergency purchase programme have had negative effects on the industry turnover numbers in Finland. The

explanatory variables of the model were able predict a high proportion of the variation in the response variable i.e., it seems that the asset purchases combined with the number of coronavirus cases explain the variation in industry turnover numbers to a high extent. However, it should be taken into account that the purchases were on an aggregate level covering whole of Europe, and as previous research has shown, the positive effects of the asset purchases do not generally expand over the industry borders (Christensen, 2019).

While there exists little-to-no prior research on the effect of quantitative easing on industries or corporations, there exists a lot of research of the effects on the whole economy. These benefits include improvement of credit availability, lower interest rates on the security in focus, higher aggregate demand from the parties involved and smaller negative impacts on real GDP and inflation (Di Maggio, 2020; Greenlaw, 2011; Urbschat, 2020; Jarrow, 2014; Kapetanios, 2012). However, the positive effects are apparent only in the securities in the focus of the asset purchases, and only as long as the purchases continue. Nonetheless, the purchases improve the economic conditions during pandemic times by increasing the liquidity in the financial system, and moreover by increasing the aggregate demand.

# 6. References

## 6.1. Literature


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